

AMENDMENTS TO THE CLAIMS

1-259. (Cancelled)

260. (New) Apparatus for spraying a liquid onto at least one vehicle surface comprising:

a liquid reservoir;

a vehicle surface liquid heating assembly receiving a liquid from said liquid reservoir, said vehicle surface liquid heating assembly comprising:

a heat-conductive element; and

a liquid heating enclosure defining a liquid heating volume including a primary liquid heating volume portion and a secondary liquid heating volume portion, separated by said heat-conductive element, said primary liquid heating volume portion including a heat exchanger for directly heating liquid in said primary liquid heating volume portion and for indirectly heating liquid in said secondary liquid heating volume portion via said heat-conductive element;

a vehicle surface liquid spraying assembly receiving heated liquid from said vehicle surface liquid heating assembly; and

a heated liquid spray control subassembly employing said vehicle surface liquid heating assembly and said vehicle surface liquid spraying assembly for providing a spray of said heated liquid onto said at least one vehicle surface.

261. (New) Apparatus according to claim 260 and wherein said heat-conductive element comprises a displaceable, resilient, flexible element.

262. (New) Apparatus according to claim 260 and wherein said heat-conductive element forms at least a wall both of said primary liquid heating volume portion and of said secondary liquid heating volume portion.

263. (New) Apparatus according to claim 260 and wherein at least said liquid heating enclosure defines a primary liquid flow pathway in said primary liquid heating volume portion and a secondary liquid flow pathway in said secondary liquid heating volume

portion, said secondary liquid flow pathway supplying liquid to said primary liquid flow pathway.

264. (New) Apparatus according to claim 260 and wherein said primary liquid heating volume portion is formed of a relatively rigid, highly heat conductive material.

265. (New) Apparatus according to claim 264 and wherein said secondary liquid heating volume portion is formed of a material which is less rigid and less heat conductive than said material forming said primary liquid heating volume portion.

266. (New) Apparatus according to claim 263 and wherein at least said primary liquid flow pathway is defined by said liquid heating enclosure and by said heat-conductive element.

267. (New) Apparatus according to claim 260 and wherein at least said liquid heating enclosure defines an at least partially turbulent flow primary liquid flow pathway in said primary liquid heating volume portion and an at least partially turbulent flow secondary liquid flow pathway in said secondary liquid heating volume portion, said at least partially turbulent flow secondary liquid flow pathway supplying liquid to said at least partially turbulent flow primary liquid flow pathway.

268. (New) Apparatus according to claim 260 and wherein said primary liquid heating volume portion is formed at least partially of a metal material, which is relatively highly heat conductive and said secondary liquid heating volume portion is formed at least partially of a plastic material, which is relatively heat insulative, separated by said heat-conductive element, said heat-conductive element being formed of a material which is less heat conductive than said metal material and more heat conductive than said plastic material.

269. (New) Apparatus according to claim 260 and wherein said heat-conductive element is apertured to permit liquid communication from said secondary liquid heating volume portion to said primary liquid heating volume portion.

270. (New) Apparatus according to claim 260 and wherein said secondary liquid heating volume portion includes at least one displaceable outer wall portion providing freeze protection by virtue of its displaceability.

271. (New) Apparatus according to claim 270 and wherein said heat-conductive element comprises a displaceable element operative to be displaced into said secondary liquid heating volume portion upon freezing of liquid inside said primary liquid heating volume portion.

272. (New) Apparatus according to claim 260 and wherein said heat-conductive element is an intervening liquid impermeable displaceable diaphragm.

273. (New) Apparatus according to claim 260 and wherein said primary liquid heating volume portion is a first conduit element and said secondary liquid heating volume portion is a second conduit element.

274. (New) Apparatus according to claim 273 and wherein said heat exchanger is defined by said first conduit element and said second conduit element.

275. (New) Apparatus according to claim 260 and wherein said at least one vehicle surface includes at least one of the following surfaces:

a front vehicle windshield surface, a back vehicle windshield surface, side vehicle windows, a vehicle headlight surface, a vehicle rear light surface, a vehicle radar antenna surface and a vehicle exterior mirror surface.

276. (New) Apparatus according to claim 260 and wherein said heated liquid spray control subassembly is operative to employ said vehicle surface liquid heating assembly and said vehicle surface liquid spraying assembly for providing a spray of liquid onto a vehicle windshield surface and a vehicle radar antenna surface.

277. (New) Apparatus according to claim 276 and also comprising a normally-open valve interconnecting vehicle windshield sprayers of said vehicle windshield surface to said vehicle surface liquid spraying assembly and being operative, when open, to bypass vehicle radar antenna sprayers of said vehicle radar antenna surface.

278. (New) Apparatus according to claim 277 and also comprising a flow restrictor, restricting liquid flow to said vehicle radar antenna sprayers to ensure liquid is supplied to said vehicle windshield sprayers when said normally-open valve is open.

279. (New) Apparatus for spraying a liquid onto at least one vehicle surface comprising:

- a liquid reservoir;

- a vehicle surface liquid heating assembly receiving a liquid from said liquid reservoir;

- a vehicle surface liquid spraying assembly receiving heated liquid from said vehicle surface liquid heating assembly; and

- a heated liquid spray control subassembly employing said vehicle surface liquid heating assembly and said vehicle surface liquid spraying assembly for providing a spray of said heated liquid onto said at least one vehicle surface; and

- a normally closed automatically operative valve interconnecting said liquid reservoir to said vehicle surface liquid spraying assembly and being operative, when open, to bypass said liquid heating assembly.

280. (New) Apparatus according to claim 279 and also comprising a vehicle pump connected upstream of said at least one liquid reservoir and downstream of said normally closed automatically operative valve.

281. (New) Apparatus according to claim 279 and wherein said at least one vehicle surface includes at least one of the following surfaces:

- a front vehicle windshield surface, a back vehicle windshield surface, a side vehicle window, a vehicle headlight surface, a vehicle rear light surface, a vehicle radar antenna surface and a vehicle exterior mirror surface.

282. (New) Apparatus according to claim 279 and wherein said normally closed automatically operative valve is a differential pressure responsive one-way valve.

283. (New) Apparatus according to claim 279 and wherein said at least one vehicle surface includes a first surface and a second surface and said apparatus also comprises a normally-open valve interconnecting vehicle sprayers of said first surface to said vehicle surface liquid spraying assembly and being operative, when open, to bypass vehicle sprayers of said second surface.

284. (New) Apparatus according to claim 283 and also comprising a flow restrictor, restricting liquid flow to said vehicle sprayers of said second surface to ensure liquid is supplied to said vehicle sprayers of said first surface when said normally-open valve is open.

285. (New) Apparatus according to claim 284 and wherein said first surface is a vehicle windshield surface.

286. (New) A method for spraying a liquid onto at least one vehicle surface comprising:

- providing a vehicle including said at least one vehicle surface and a liquid reservoir;

- supplying said liquid from said liquid reservoir to a vehicle surface liquid heating assembly including a primary liquid heating volume portion and a secondary liquid heating volume portion, separated by a heat-conductive element;

- directly heating said liquid in said primary liquid heating volume portion, thereby indirectly heating said liquid in said secondary liquid heating volume portion via said heat-conductive element; and

- thereafter spraying said liquid onto said at least one vehicle surface.

287. (New) A method according to claim 286 and wherein said spraying includes spraying said liquid for an initial spray cycle.

288. (New) A method according to claim 287 and wherein said indirectly heating liquid in said secondary liquid heating volume portion during a relatively long time duration after initial operation of a motor of said vehicle causes said initial spray cycle to be relatively longer than when said indirectly heating liquid in said secondary liquid heating volume portion is during a relatively short time duration after said initial operation of said motor of said vehicle.

289. (New) A method according to claim 287 and wherein said spraying said liquid onto said at least one vehicle surface is nearly instantaneous when said indirectly heating liquid in said secondary liquid heating volume portion is for a relatively short time duration after said initial operation of said motor of said vehicle.

290. (New) A method according to claim 287 and wherein said indirectly heating liquid in said secondary liquid heating volume portion during a relatively long time duration after a previous spray cycle causes said initial spray cycle to be relatively longer than when said indirectly heating liquid in said secondary liquid heating volume portion is during a relatively short time duration after said previous spray cycle.

291. (New) A method according to claim 287 and wherein said spraying said liquid onto said at least one vehicle surface is nearly instantaneous when said indirectly heating liquid in said secondary liquid heating volume portion is for a relatively short time duration after a previous spray cycle.

292. (New) A heated liquid discharge system comprising:
a main assembly which provides liquid heating and includes electrical and liquid flow control functionalities;
a liquid inflow conduit supplying liquid from a liquid reservoir to said main assembly; and
a liquid outflow conduit supplying liquid to at least one sprayer located at at least one location on a motor vehicle,

said liquid inflow conduit having connected in series therewith a leaky one-way valve which permits limited backflow of liquid from said main assembly to said reservoir.

293. (New) A heated liquid discharge system according to claim 292 and wherein said main assembly comprises a liquid heating chamber communicating with said liquid inflow conduit and said liquid outflow conduit and being formed with a liquid drain aperture located on a side thereof which permits draining of liquid from said liquid heating chamber generally down to a level of said liquid drain aperture via said leaky one-way valve.

294. (New) A heated liquid discharge system according to claim 293 and wherein said draining takes place when a vehicle pump supplying liquid to said liquid inflow conduit is not in operation.

295. (New) A heated liquid discharge system according to claim 292 and wherein said at least one location includes at least one of the following locations:

front vehicle windshield, back vehicle windshield, side vehicle windows, vehicle headlights, vehicle rear lights and vehicle exterior mirrors.

296. (New) A heated liquid discharge system according to claim 292 and also comprising an overheating cut-off fuse for shutting off electrical power to at least part of said main assembly in the event of overheating of a liquid heating chamber located within said main assembly.

297. (New) A heated liquid discharge system according to claim 296 and wherein said fuse is formed with an undersurface of a resilient material and is retained in tight thermal engagement with the underside of a base of a liquid heating element located within said liquid heating chamber.

298. (New) A heated liquid discharge system according to claim 293 and wherein said liquid drain aperture together with said leaky one-way valve provides both

overheating and anti-freezing protection for said main assembly.

299. (New) Apparatus for spraying a liquid onto at least one vehicle surface comprising:

a liquid reservoir;

a vehicle surface liquid heating assembly receiving a liquid from said liquid reservoir;

a vehicle surface liquid spraying assembly receiving heated liquid from said vehicle surface liquid heating assembly; and

a heated liquid spray control subassembly employing said vehicle surface liquid heating assembly and said vehicle surface liquid spraying assembly for providing a spray of said heated liquid onto said at least one vehicle surface,

said spray of said heated liquid being automatically activated by an automatic gain control circuit (AGC) actuation signal.